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The Effect of Different Levels of Raw and Soaked Bitter Vetch (Vicia Ervilia) on Fattening Performance of Lori Lambs

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Abstract

This study was done in one of the semi-industrial sheep business in Doroud city to evaluate the effect of raw and soaked Bitter Vetch (Vicia ervilia) seed consumption on growth and carcass characteristics of fattening lambs on 49 weaned Lori ram lambs, with an average initial weight of 23 ± 0.75 kg and in the form of a completely randomized design with 7 treatments including control treatments and different levels of raw and soaked Bitter Vetch (15, 21, 27% of diet) by replacing soybean meal for 105 days. Diets were similar in terms of energy and protein. Growth characteristics such as daily weight gain, feed intake, feed conversion and carcass characteristics including lean meat, fat and bone breakdown in the body parts were examined and recorded. Obtained information was recorded in Foxpro database and was analyzed by SAS software and GLM method. The independent means compare plan (orthogonal) was used to achieve the presence or absence of a difference between the use of raw and soaked Bitter Vetch and Duncan test was used to compare the treatments. The test results showed that the average weight and characteristics' percentage like carcass loss, hot carcass, cold carcass, final live weight, lean meat, bone, fat, subcutaneous fat, inter-muscle fat, carcass yield, and LDM muscle area in control treatment (Soybean Meal) showed no significant difference in relation to treatments containing dried and soaked bitter vetch with 15% and 21% levels but compared to the 27% dried and soaked bitter vetch showed significant gain. The amount of visceral fat lambs of control group was significantly higher than other treatments. The weight of liver, kidneys and spleen in lambs fed with diets containing bitter vetch was significantly higher compared to control treatment but the weight of heart and lungs in lambs that are fed in control treatment was not significantly different from other treatments. The comparison of orthogonal of the effects of using dried bitter vetch compared to soaked bitter vetch showed no significant difference. Growth performance of lambs in the group containing 27% dried and soaked bitter vetch compared to other levels of bitter vetch and control diet showed significant reduction. These results suggest that bitter vetch can be used as a protein supplement up to 21% of the total diet without negative effects on growth performance of lambs.

Keywords: bitter vetch, Lori lambs, carcass characteristics, growth traits

Introduction

The most important thing about livestock raising refers to their feed management that the diet should be provided at reasonable prices. The problem that most of animal breeders is confronted to it is the use of edible sources that are not domestically produced and are considered as imported items and it is important for farmers to be able to promote the use of local delicacies and raise production efficiency by reducing price (Mikic, Peric, Dordevic, Srebric, and Mihailovic, 2009; Enneking, and Franceis, 2000). The use of imported food items due to its foreign currency burden is not reasonable and sooner or later the agricultural sector and industry should solve this problem and

makes needless the country from the import of the materials that their production does not require more technology. The use of other food items in the diet depends on their availability in each region (Latifi, 1996). Bitter vetch is a member of the legume family that is used to feed livestock and poultry and also in ancient times it was used to feed people in times of famine and its scientific name is Vicia ervilia (Mikic, Peric, Dordevic, Srebric, and Mihailovic, 2009). In Iran bitter vetch is usually cultivated in late fall as rainfed in the foothills of the West provinces of country and is harvested in late spring and early summer. The average production of product in Iran is about 800 to 1000 kg per hectare and the amount of its produced straw is 1.2 to 1.4 ton per hectare. This plant is resistant to cold, drought and pest. One of the problems of bitter vetch cultivation development is traditional harvesting by hand which is due to the short base of plant (Shema, Saedi, 1991). Bitter vetch is regarded as a valuable food for animal feed so that the rate of dry matter, crude protein, crude fiber, crude fat, and N. F. A. of its seed is 95.03%, 22.21%, 7.75%, 2.43%, and 63.4% respectively and straw of bitter vetch has 6.72% crude protein (Ali Arabi, 1997). Despite the proper nutritional value of this seed for ruminants, the seed can be harmful for monogastric especially for chickens. These adverse effects may be caused by the presence of anti-nutritional factors such as El Kanavanyn, glucoside Syanvznyk, trypsin inhibitor, catechin and a type of specific lectin. Hence, the continuous feeding of this seed can be problematic, however bitter vetch is a good source of minerals, especially iron and copper and its amino acid pattern except in the case of sulfur-containing amino acid is good and comparable to soy. It should be noted that its first limiting and desirable amino acid is methionine and lysine respectively (Tabatabai, Ali Arabi, Kafilzadeh, Kayani, 2000). Few studies were done on the use of this valuable grain in the diet of these fattened sheep but their results have indicated favorable effects of grain on the yield and growth of fattened lambs (Kiyanzad, 1993). The aim of this study was to determine the effects of appropriate level of bitter vetch as suitable supplement protein in diets of fattened lambs.

Materials and methods

49 Lori post weaning ram lambs with an average initial weight of 0.75 ± 23 kg were selected randomly and were fattened in a completely randomized design in 7 treatments with 7 replicates for 105 days. Before the experiment began the chemical composition of a few sample of bitter vetch in laboratory of animal feed livestock of Deputy of Agricultural Jihad Organization of Lorestan was determined by using AOAC 2000 method. To study the effects of using different levels of bitter vetch as an alternative protein sources in the diet of fattened ram lambs, seven diets (treatments) with different levels of bitter vetch including control treatment containing soybean meal (without the bitter vetch), diets containing 15%, 21%, and 27% of the total ration of dried bitter vetch, and rations containing 15%, 21%, 27% of the total ration of soaked bitter vetch in water were tested respectively. The experimental diets were adjusted based on dried matter including 40% forage and 60% concentrate and the amount of nutrients in experimental diets according to the suggestion of standard tables NRC 1998 with 2.6 energy megacalories kg of dry matter and 15.5% crude protein content (Table 1 and 2). After performing livestock health measures, rations were thoroughly prepared in the TMR mixed form and were daily available in the morning and evening for lambs. During the experiment, water and rock salt was freely available for livestock. After a two-week adaptation period, tested lambs were maintained for 12 hours without food and water and then were weighed and placed in solitary boxes. This pilot scheme was done for 105 days in one of the semi-industrial sheep business in Dorud city. The feed intake of each animal and its remaining was daily measured and recorded. In order to determine changes in body weight, lambs were individually weighted once every two weeks and before the morning feeding by weighting scale with accuracy of 100 grams. At the end of the fattening period all lambs were weighted and then were slaughtered in

Islamic slaughterhouse. The weight of all internal organs such as the liver, lungs, heart, spleen, kidneys, testes and visceral fat were measured with a digital scale with a precision of 10 g and recorded. Hot carcasses after slaughter of the animals were weighed and then were transferred to cold storage with 5 ° C and were kept for 12 hours and after cooling were weighted and then from the middle longitudinal axis were divided into two parts. Analysis of right side of carcass based on the Fried method of carcass analysis was cut to neck, hand, chest, kidney, scenics, hip and tail and was separated and weighted in each part of the bone, meat, subcutaneous fat and inter-muscle fat (Farid, 1991). Zeolite by putting a Calc sheet on it was designed and the intended area was calculated by using planimetry. Backfat thickness in the area of the ribs was calculated and recorded 12 and 13 by caliper measurement. In order to determine the chemical composition of the soft tissue, lean meat, inter-muscular fat, subcutaneous and tail fat every half carcass was mixed together and passed twice through a meat grinder with a diameter of 4 mm then two randomly selected samples weighing 200 g inside the plastic bag by indicating the number of supply were sent to livestock laboratory of Deputy of Agricultural Jihad Organization of Lorestan to determine the amount of moisture, crude fat percentage, crude protein and ash soft tissue. In laboratory the fat percentage was measured by Soxhlet method and protein percentage by Keldal method. At the end, the obtained data were recorded in Foxpro database software and were analyzed by SAS statistical software and GLM method. Treatments mean comparison was performed by using orthogonal and Duncan method.

Table 1: The combination and percentage of food in experimental diets based on dry matter

Foodstuffs	Rations			
	Control	15% Bitter vetch	21% Bitter vetch	27% Bitter vetch
Dry hay	10	10	10	10
Corn Silage	15	15	15	15
Barley straw	15	15	15	15
Wheat bran	13	10	7	4
Barley	35	25	24	23
Soybean meal	10	8	6	4
Bitter vetch	0	15	21	27
Salt	0.3	0.3	0.3	0.3
Premixes	0.5	0.5	0.5	0.5
Calcium carbonate	1.2	1.2	1.2	1.2
Sum	100	100	100	100

Levels 15%, 21% and 27% of bitter vetch were used once in dry form and once in soaked form namely sixth treatments with a control treatment.

Table 2: Chemical composition of experimental diets

Chemical composition of diets	Control diet	15% Bitter vetch	21% Bitter vetch	27% Bitter vetch
dry matter%	77.9	78.58	79.01	79.44
Crude protein%	15.5	15.5	15.5	15.5
Crude fat%	2.26	2.15	2.01	1.9
Metabolizable energy Mcal / kg	2.6	2.6	2.6	2.6
Ash%	5	4.85	4.69	4.51
Crude fiber%	18.05	17.85	17.69	17

Results and discussion

Chemical compounds of bitter vetch

Chemical compounds of bitter vetch based on the dry matter are shown in Table 3. Crude protein content of the grain was about 23% which was a good source of protein and was similar to the results of Gonzales et al and Haddad and colleagues (Haddad and Husein, 2004; Duck, and Gubete,1989). However, Sadeghi and colleagues reported a 25% protein content for it. According to the NRC definition foods that contain 20% or more crude protein per kg are dry matter that are regarded as a protein supplement. Therefore, bitter vetch is a protein supplement. On the other hand, its energetic value is as barley and corn.

Table 3: The determined chemical composition of bitter vetch used in experimental diets

dry matter%	Raw Power%	Crude protein%	Crude fat%	Ash%	Crude fiber%	Calcium %	Phosphor%
93±1.3	4128±38	23.12±2.28	4.97±0.41	1.7	6.2	0.92	0.20

Average dry matter intake, daily weight gain, feed conversion ratio

Table 4: Average dry matter intake, daily weight gain and feed conversion ratio of each treatment is shown in this table.

Feed conversion coefficient	Feed intake mean (kg)	Daily overweight Mean (g)	Treatment
6/9[a]	131/9[a]	[a]181	Control
7/5[a]	141/7[a]	[a]179	15% Bitter Vetch
7/2[a]	138/2[a]	[a]183	21% Bitter Vetch
8/2b	128/3b	149	27% Bitter Vetch
7/1[a]	135/6[a]	[a]182	15% Bitter Vetch
7/2[a]	143/3[a]	[a]190	21% Bitter Vetch
8b	127/2b	151	27% Bitter Vetch

*In each column, numbers with dissimilar letter have significant difference

Analysis of data showed no significant difference in the average dry matter intake and daily weight gain and feed conversion ratio in control treatment compared to diets containing 15% and 21% dried and soaked bitter vetch, but compared to treatment with 27% dried and soaked bitter vetch was significantly higher.

Table 5: Comparison of growth traits mean influenced by experimental treatments

Organ weight (g)	Control	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch
Heart	148	149	155	164	147	152	163
Lung	455	470	466	478	467	459	453
Spleen	59	62	65	73	61	63	69
Liver	666	698	745	895	690	729	869
Kidney	99	105	108	121	102	106	119

It seems that due to high crude protein degradation of bitter vetch in the rumen, high levels of bitter vetch in the diet of 27% were led to disruption of the balance of analyzed protein in the rumen and metabolism of microbial protein synthesis and consequently, enhancement of the concentration of ammonia in the rumen, causing symptoms of poisoning, reduction of dry matter

intake and reduction of growth. These data are consistent with data of Raymond and Fernando (2002). Haddad and colleagues have declared the reason of high feed conversion ratio in this way that bitter vetch contains anti-nutritional factors such as proteases, tannins and Kanavanian and in the rations of 27% bitter vetch due to high levels of tannin, the ability of combining with proteins and cell wall polymers was increased which reduced the absorption of the protein.

Comparison of weight mean of different organs of lambs (non-carcass components)

The comparison of weight mean of different organs of lambs is shown in Table 5. Data analysis showed that the average weight of the heart and lungs of lambs fed with control treatment compared to other treatments was not significantly different. However, by increasing the numerical levels of bitter vetch the weight of these organs was rising. The average weight of organs of liver, spleen and kidneys of control treatment, 15% and 21% dried and soaked bitter vetch had not significant difference compared to each other but showed significant reduction in relation to 27% treatment. The increase in treatment 27% can be due to the high degradable of protein of bitter vetch and high metabolism of the urea cycle in the liver and enhancement of kidney function. Also, the presence of anti-nutritional substances in bitter vetch leads to enzyme dysfunction and excessive activity of pancreas and ultimately abnormal enlargement of pancreas, liver and kidneys. These results are consistent with study results of Vanderpool (1991) and McLeod (1974). Weight of liver, spleen and kidneys in treatments containing levels of dry bitter vetch was significantly higher than the treatments with soaked bitter vetch levels.

The reason for this difference could be due to the solution and exclusion of a part of anti-nutritional substance while soaking bitter vetch.

Table 6: The comparison of the average weight of lambs' organs

Carcass component weight (Kg)	Treatments						
	Control	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch	15% Bitter Vetch
Hot carcass	21/40a	18/85a	20/95a	18/35b	20/77a	21/1a	18/7b
Cold carcass	20/66a	20/53a	20/28a	18/29b	20/32a	20/63a	18/31b
Carcass efficiency (%)	49/9a	50/13a	48/72a	48/92b	49/12a	49/55a	48/32b
Hot lean meat	10143a	10223a	10040a	8687b	9840a	10620a	8770b
Bone	2945a	3267a	3138a	2943b	3214a	3175a	3037b
Inter-muscle fat	854a	786a	618a	534b	722a	593a	502b
Hot subcutaneous fat	1245a	1034a	1113a	1147b	1078a	1200a	1012b
Visceral fat	2795a	2264b	1948b	1950b	2156b	2267b	1901b
Tail fat	1823a	1645a	1657a	1750b	1694a	1869a	1827b
LDM muscle area (cm)	18/82a	18/3a	18/94a	16/93b	18/55a	19/1a	16/77b

The comparison of carcass traits' averages

The average of carcass traits of lambs fed with the experimental diets is shown in Table 6. Statistical analysis of obtained data showed that the carcass of lambs fed with control treatment and treatments containing 15 % and 21% levels of dried and soaked dried and soaked bitter vetch had no significant difference in terms of the hot carcass weight, cold carcass weight, percentage of carcass yield, lean meat, bone, inter-muscle fat, subcutaneous and tail fat, and LDM muscle area, but compared to 27% treatment of dried and soaked bitter vetch showed significant increase. The visceral fat of lambs' carcass in the control group was significantly higher than other treatments ($P<0.05$).

These results were in line with the study results of Haddad and colleagues (Haddad, 2005).

The mean comparison of the carcass traits of treatments showed no significant difference in terms of dried or soaked bitter vetch ($P<0.05$).

The mean comparison of chemical composition of carcass of lambs fed with experimental diets.

Considering the results of chemical composition of carcass of lambs fed with different treatments showed that the carcass combination of lambs of control treatment had no significant difference with other treatments (Table 7).

Table 7: The average of chemical composition of carcass of lambs fed with experimental diets

Treatment	N	Protein (%)	Fat (%)	Raw materials (%)	Remained materials (%)
Control	5	16/1	33	49/3	1/07
15% Bitter Vetch	5	15/6	32/3	50/3	1/4
21% Bitter Vetch	5	15/7	30/8	52/4	1/2
27% Bitter Vetch	5	15/5	30	53	1/1
15% Bitter Vetch	5	15/5	32/5	50/7	1/3
21% Bitter Vetch	5	15/4	30/9	52/5	1
27% Bitter Vetch	5	15/9	30/1	52/7	1/2
Results of treatment means	5	NS	NS	NS	NS
Results of dry and soaked materials	5	NS	NS	NS	NS

NS: There is no significant difference between averages.

Conclusion

This study was done in one of the semi-industrial sheep business in Doroud city to evaluate the effect of raw and soaked Bitter Vetch (Vicia ervilia) seed consumption on growth and carcass characteristics of fattening lambs on 49 weaned Lori ram lambs, with an average initial weight of 23 ± 0.75 kg and in the form of a completely randomized design with 7 treatments including control treatments and different levels of raw and soaked Bitter Vetch (15, 21, 27% of diet) by replacing soybean meal for 105 days. The test results showed that the average weight and characteristics' percentage like carcass loss, hot carcass, cold carcass, final live weight, lean meat, bone, fat, subcutaneous fat, inter-muscle fat, carcass yield, and LDM muscle area in control treatment (Soybean Meal) showed no significant difference in relation to treatments containing dried and soaked bitter vetch with 15% and 21% levels but compared to the 27% dried and soaked bitter vetch showed significant gain. The weight of liver, kidneys and spleen in lambs fed with diets containing bitter vetch was significantly higher compared to control treatment but the weight of heart and lungs in lambs that are fed in control treatment was not significantly different from other treatments. The comparison of orthogonal of the effects of using dried bitter vetch compared to soaked bitter vetch showed no significant difference. Growth performance of lambs in the group containing 27% dried and soaked bitter vetch compared to other levels of bitter vetch and control diet showed significant reduction. These results suggest that bitter vetch can be used as a protein supplement up to 21% of the total diet without negative effects on growth performance of lambs. In conclusion, the use of bitter vetch as dry or soaked up to 21% of total dry matter as protein supplement improves the growth performance of lambs.

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